
# Ecological Risk Assessment for Wildlife

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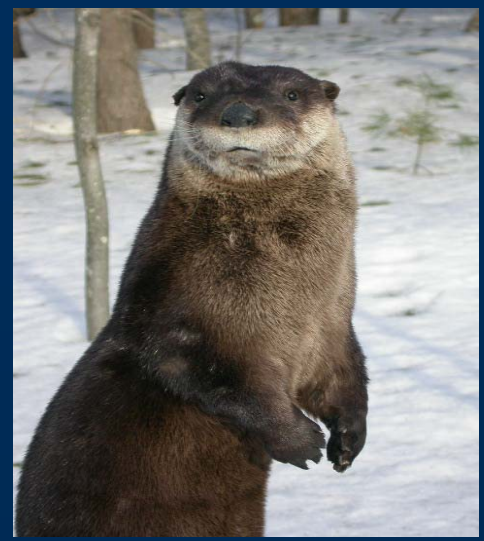
# Overview

- Assessment endpoints and representative species
- Lines of evidence and measurement endpoints
- Site-specific studies
- ERA methods
  - Exposure assessment
  - Effects assessment
  - Risk characterization
- ERA results
- Summary of risks to wildlife

# Assessment Endpoints and Representative Species

- Survival, growth, and reproduction of:
  - Insectivorous birds
    - Tree swallow and American robin
  - Piscivorous birds
    - Osprey and belted kingfisher
  - Piscivorous mammals
    - Mink and river otter



# Assessment Endpoints and Representative Species

- Survival, growth, and reproduction of:
  - Omnivorous and carnivorous mammals
    - Red fox and Northern short-tailed shrew
  - Threatened and endangered species
    - Bald eagle, American bittern, small-footed myotis

# Lines of Evidence

| Assessment Endpoint | Modeled Exposure And Effects | Field Study | Site-specific Toxicity |
|---|---|---|---|
| Insectivorous Birds | ✓ | | Tree Swallow, Robin |
| Piscivorous Birds | ✓ | | Belted Kingfisher |
| Piscivorous Mammals | ✓ | Mink | Mink |
| Omn/Carn Mammals | ✓ | Shrew | Shrew |
| T & E Species | ✓ | | |

# Modeled Exposure and Effects: Exposure Assessment

Exposure estimated from:

- Diet
- COC concentrations
- Food intake rate
- Foraging range

# Modeled Exposure and Effects: Exposure Assessment

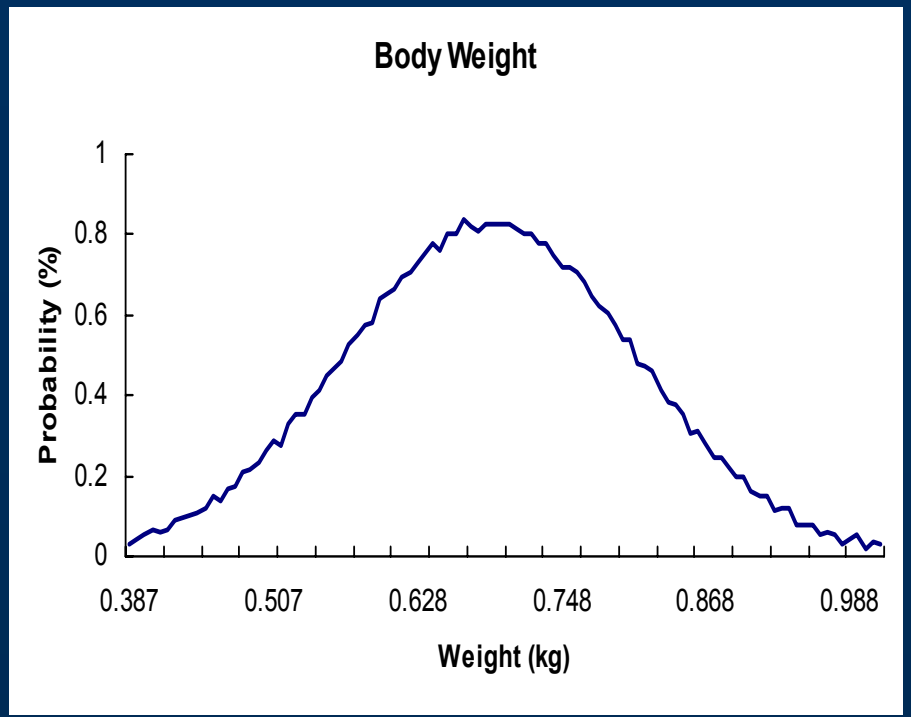
Probabilistic Risk Assessment

- Used distributions when there was uncertainty
- Methods propagated uncertainty through models
- Monte Carlo analysis
- Probability bounds analysis

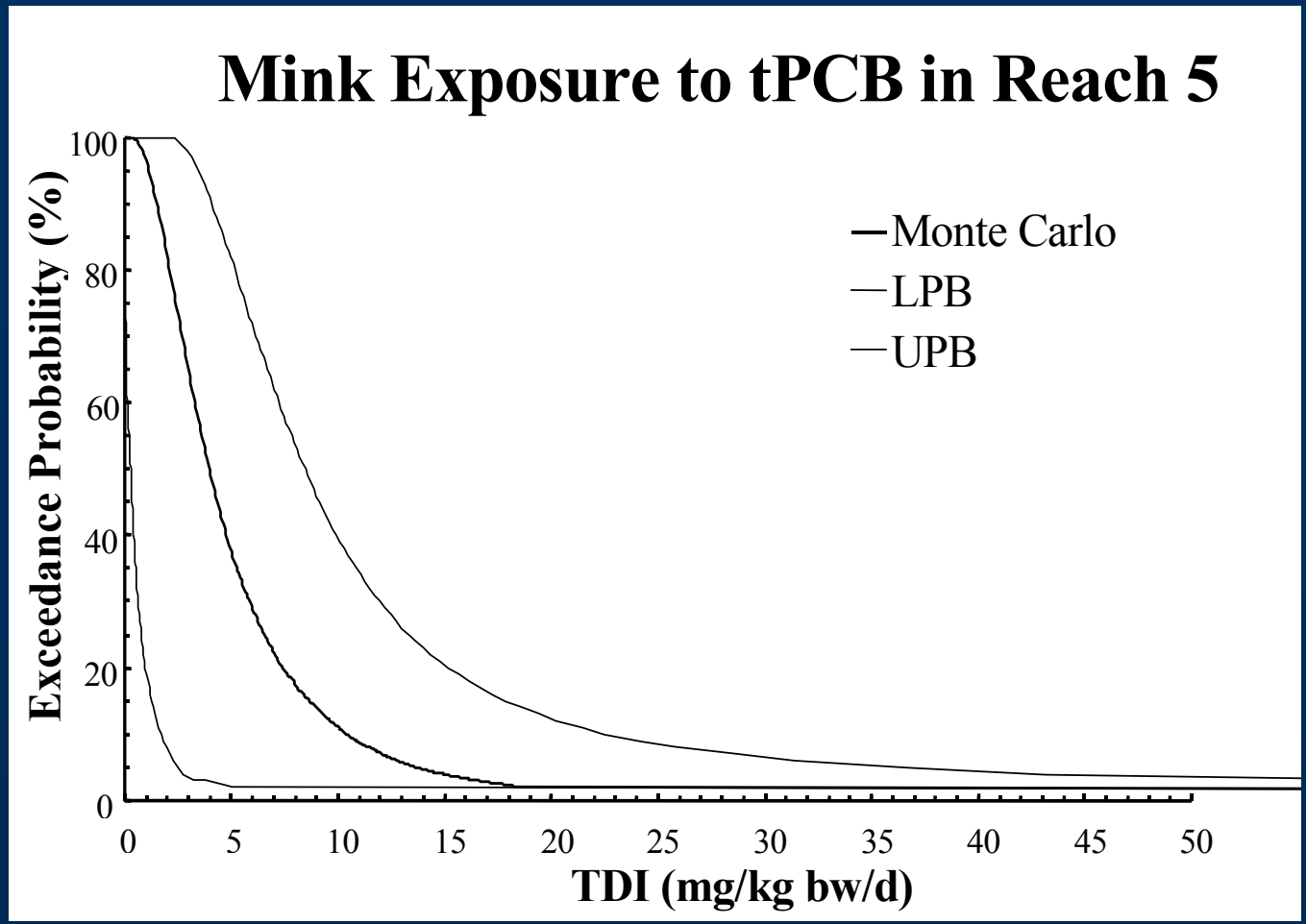
# Modeled Exposure and Effects: Example Exposure Analysis

**Mink exposure model input parameters:**

- Body weight (as shown)
- Food intake rate inputs
- Proportion diet:
  - –Fish
  - –Invertebrates
  - –Birds
  - –Mammals
  - –Amphibians



# Modeled Exposure and Effects: Example Output

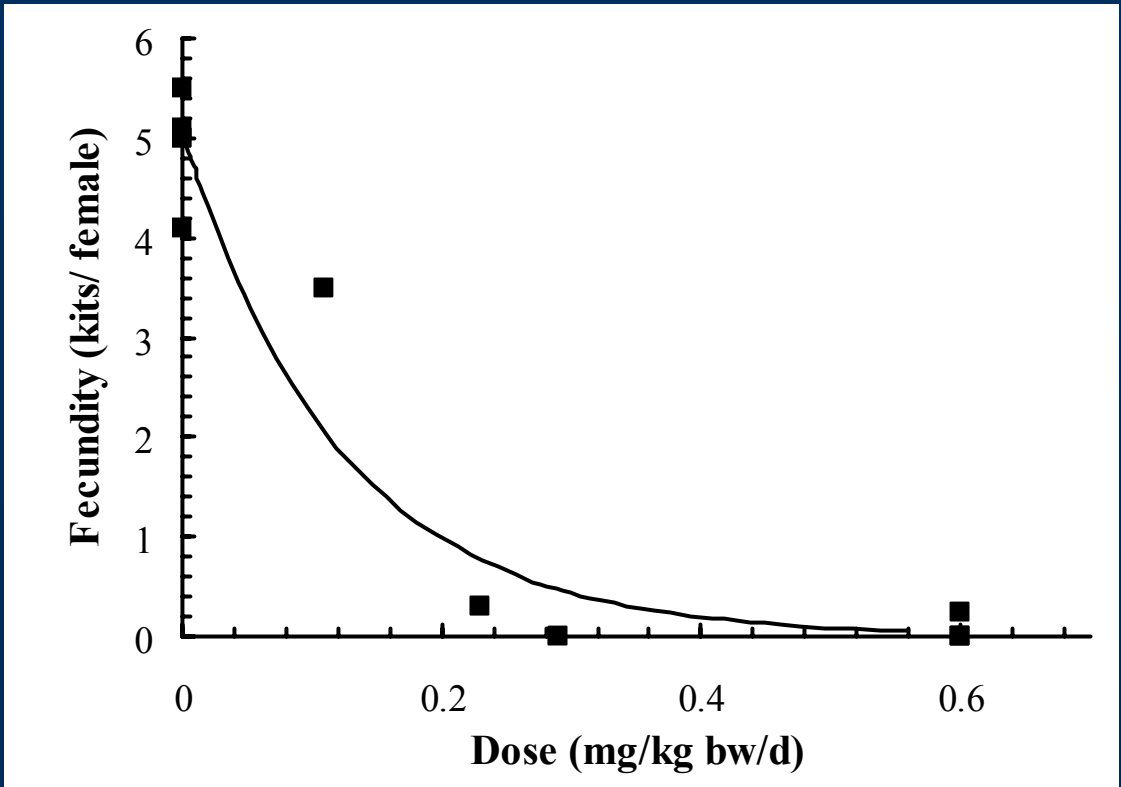


# Modeled Exposure and Effects: Effects Assessment

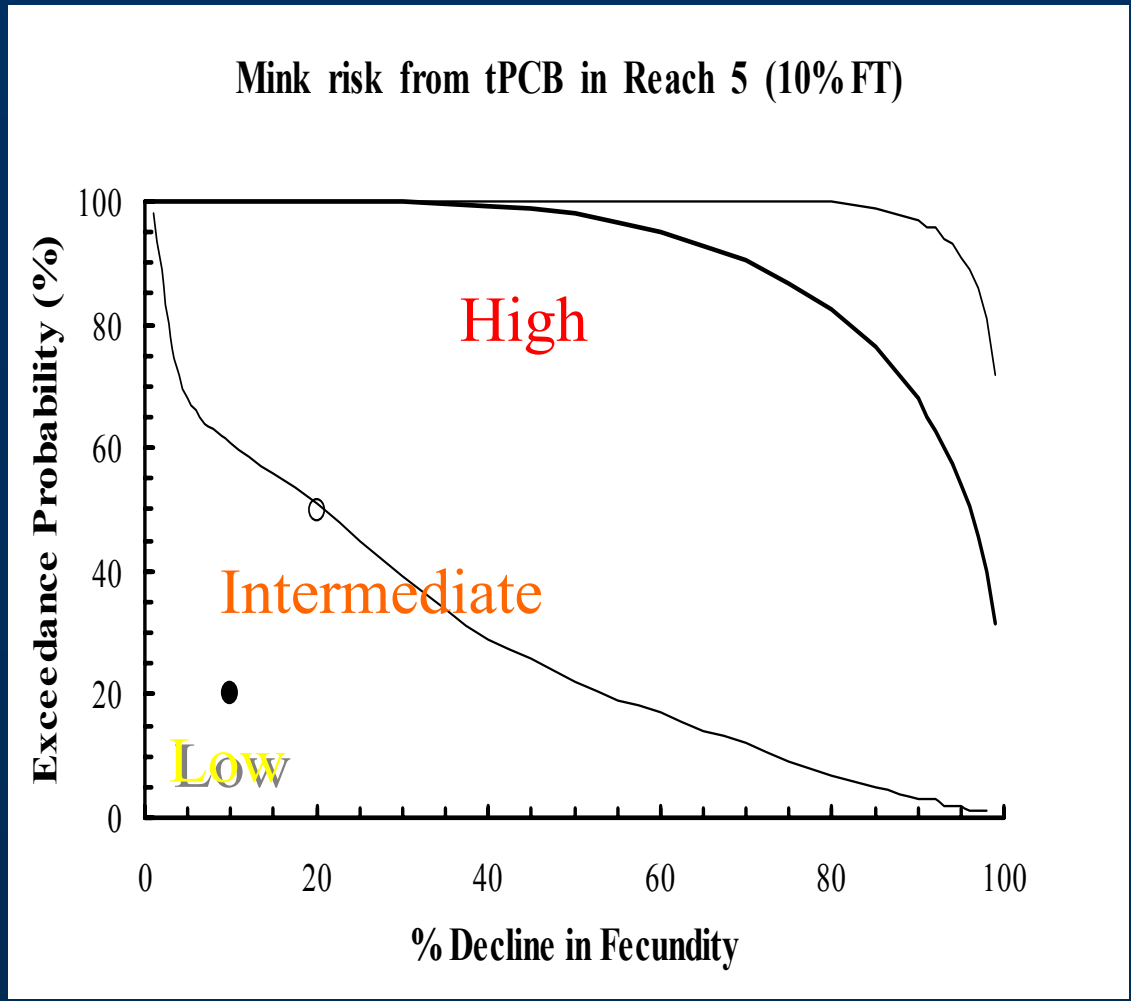
- Focused on literature studies
  - survival, reproduction and growth
- Few published studies available for birds
- More literature for mammals
- In a few cases, site-specific field studies were used to derive effects metrics

# Modeled Exposure and Effects: Example Dose-response Curve

## Effects of tPCBs on Reproduction of Mink

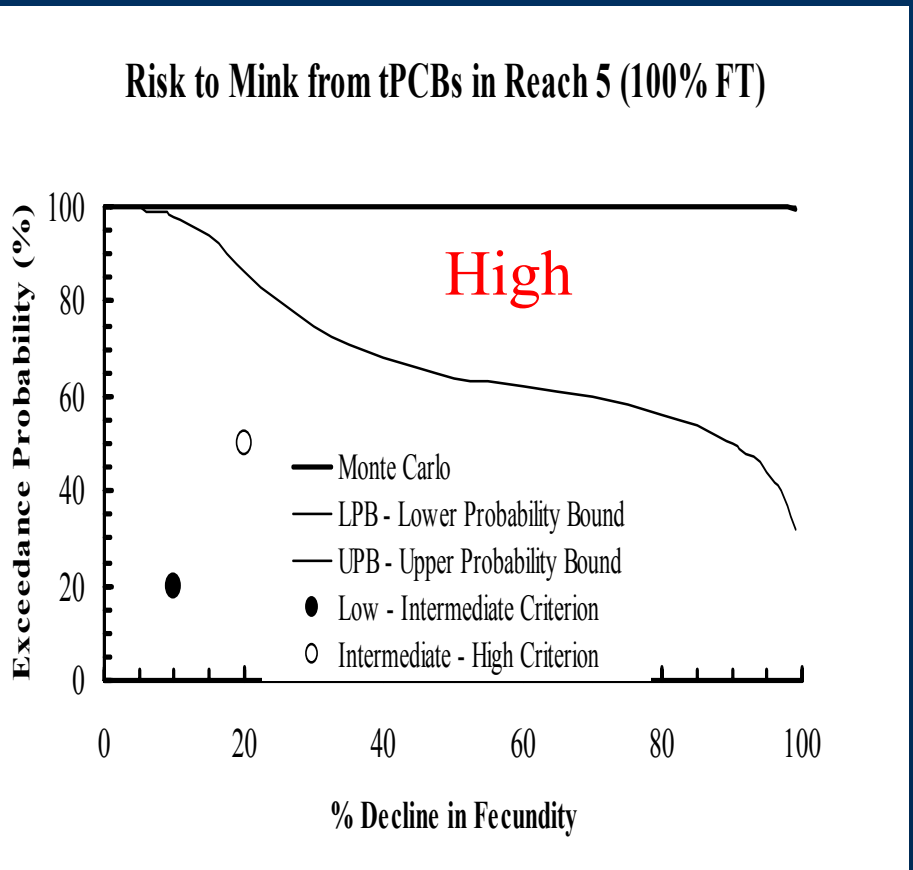


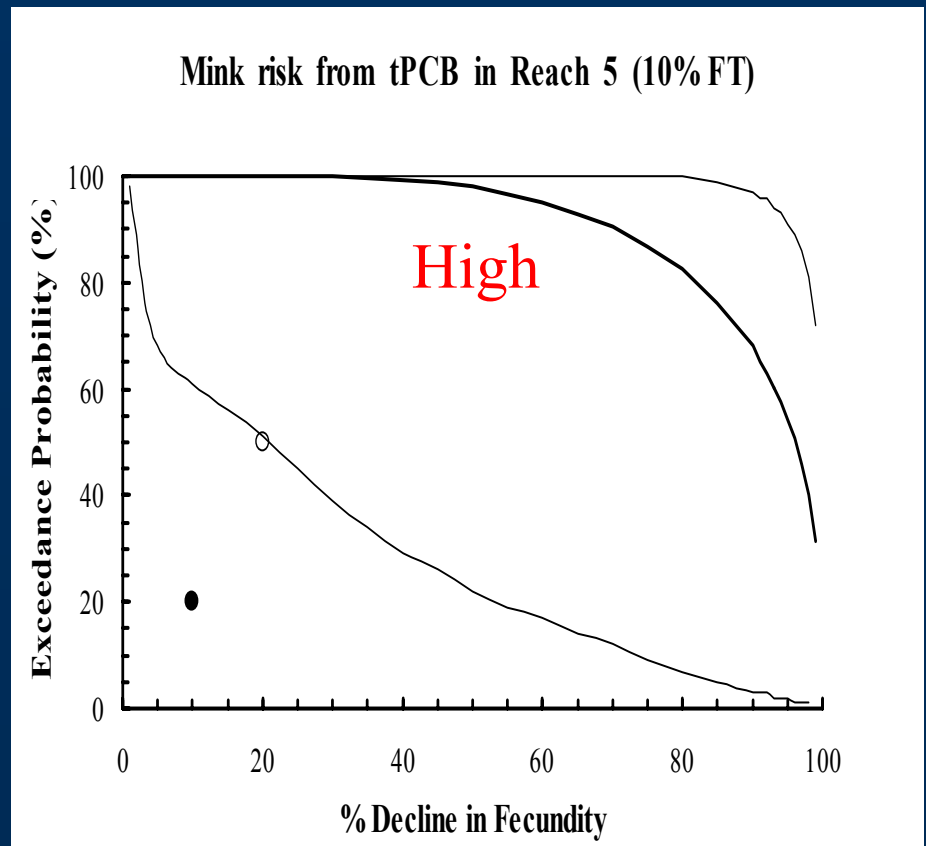
# Modeled Exposure and Effects: Example Risk Curve



# PISCIVOROUS MAMMALS

# Results – Modeled Exposure and Effects for Mink



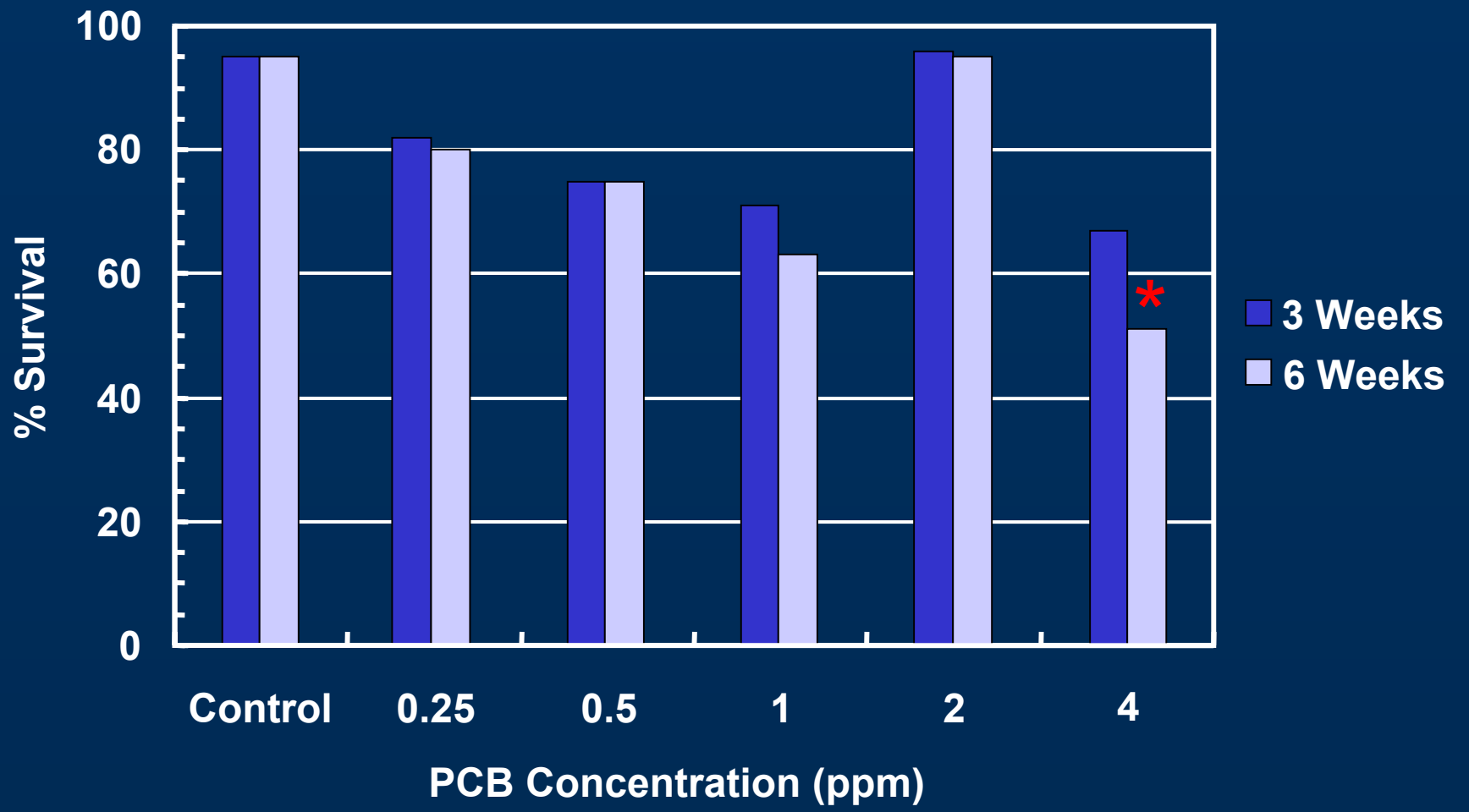
# Field Studies - Methods

- Field Surveys (Appendix A; Bernstein et al. 2003)
  - Woodlot recorded presence and relative abundance of mink and otter in PSA and reference areas from 1998 to 2001
  - Bernstein et al. conducted a study in the PSA using similar methods from 2001 to 2003
- Feeding Study (Bursian et al. 2002; Bursian & Yamini 2003)
  - fed fish collected from Woods Pond
  - monitored reproduction and development
  - 6 dose treatments

# Field Studies - Results

- Field surveys (EPA and GE)
  - mink and otter present in PSA in winter, but rare otherwise
  - mink and otter more common in reference areas
- Feeding study
  - adverse effects on survival of 6 week-old kits
  - dose-dependent incidence of jaw lesions

# Mink Feeding Study: Effect of PCBs on Kit Survival



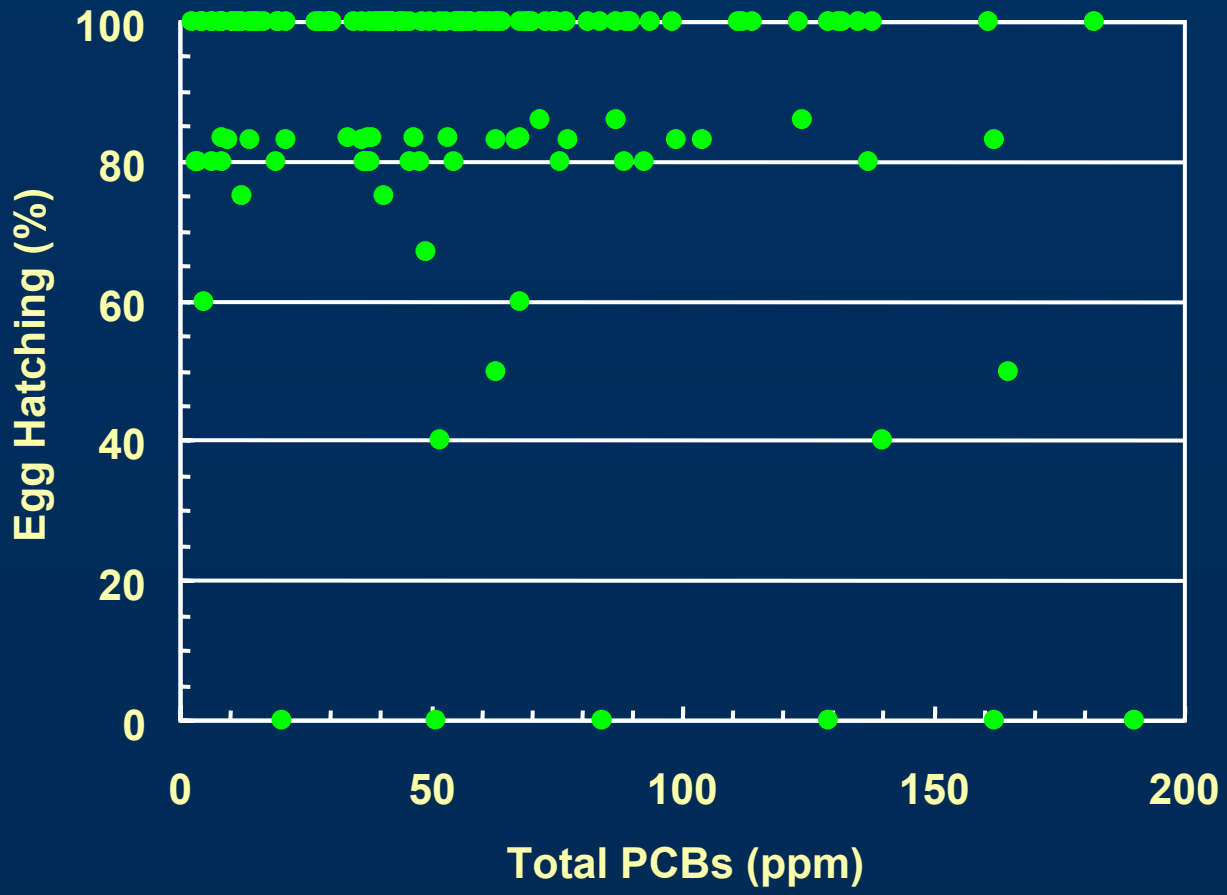
# WOE – Piscivorous Mammals

| Measurement Endpoints | | Weighting Value (High, Moderate, Low) | Evidence of Harm (Yes, No, Undetermined) | Magnitude (High, Intermediate, Low) |
|---|---|---|---|---|
| Field Surveys | EPA | Moderate/High | Yes | High |
| | GE | Moderate | No | Low |
| Feeding Study | | High | Yes | High |
| Modeled Exposure and Effects | | Moderate/High | Yes | High |

# ERA Results – Insectivorous Birds

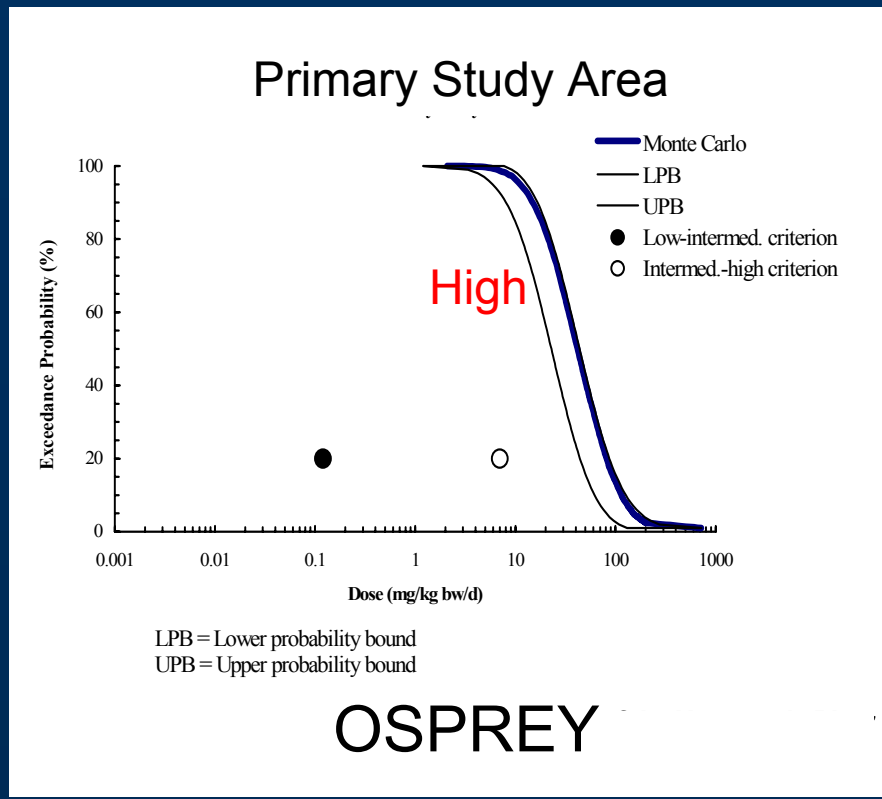
- Modeled exposure and effects
  - intermediate to high risk
  - moderate weight
- Tree swallow field study (Custer 2002)
  - monitored reproduction of tree swallows in nest boxes for 3 years
  - 3 locations in PSA, 3 reference locations
  - No obvious adverse effects on reproduction
- American robin field study (Henning 2002)
  - monitored reproduction of robins for 1 year
  - within PSA floodplain (contaminated), outside PSA floodplain (uncontaminated)
  - No obvious adverse effects on reproduction
- WOE conclusion: **Low** Risk

# Tree Swallow Study: Hatching Success Results



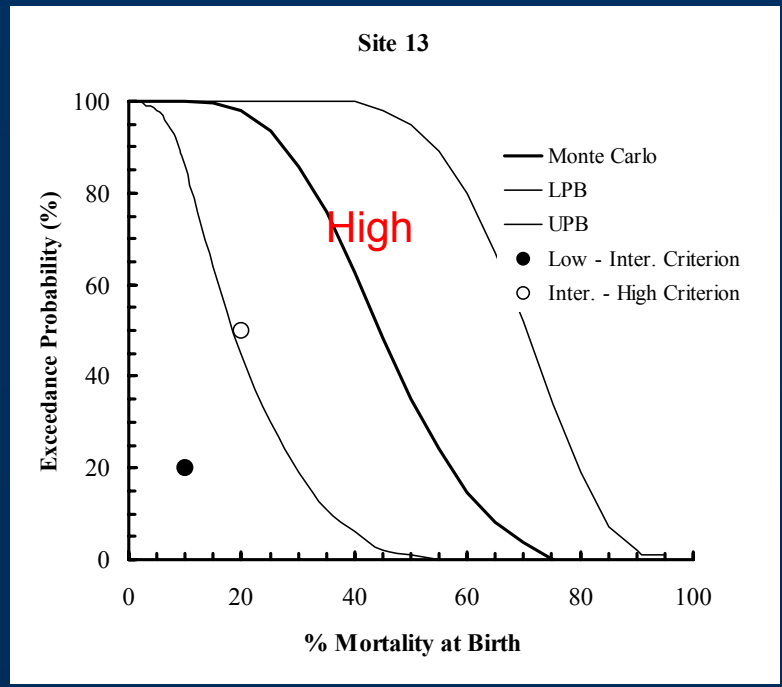

# ERA Results – Piscivorous Birds

- Modeled exposure and effects
  - high risk
  - moderate weight
- Belted kingfisher field study (Henning 2002)
  - monitored reproduction of kingfishers for one year
  - 9 kingfisher burrows in PSA
  - no evidence of adverse effects
  - moderate-high weight
- WOE conclusion: **Intermediate** to **High** Risk for some species



# ERA Results – Omnivorous and Carnivorous Mammals

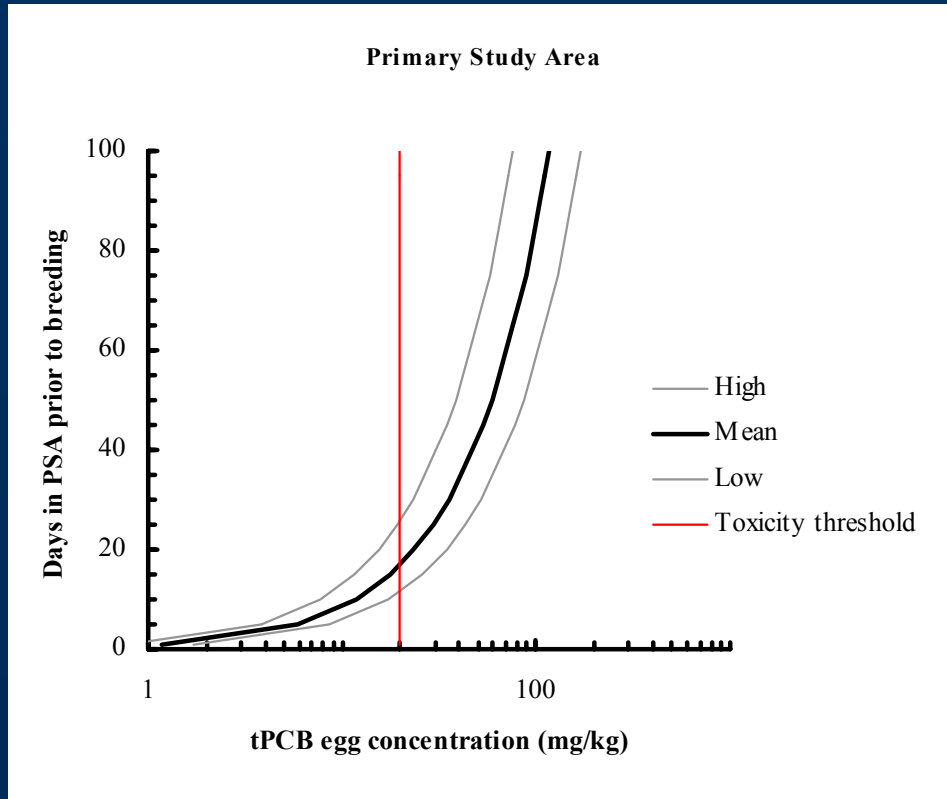
- Modeled exposure and effects
  - low to high risk
  - moderate-high weight
- Small mammal field survey (Appendix A)
  - presence, relative abundance and habitat usage from 1998 to 2001
  - low risk
  - moderate-high weight
- Shrew field study (Boonstra 2002)
  - survival, reproduction, growth, population density, sex ratio for 1 year
  - 6 locations in PSA
  - intermediate risk
  - moderate-high weight



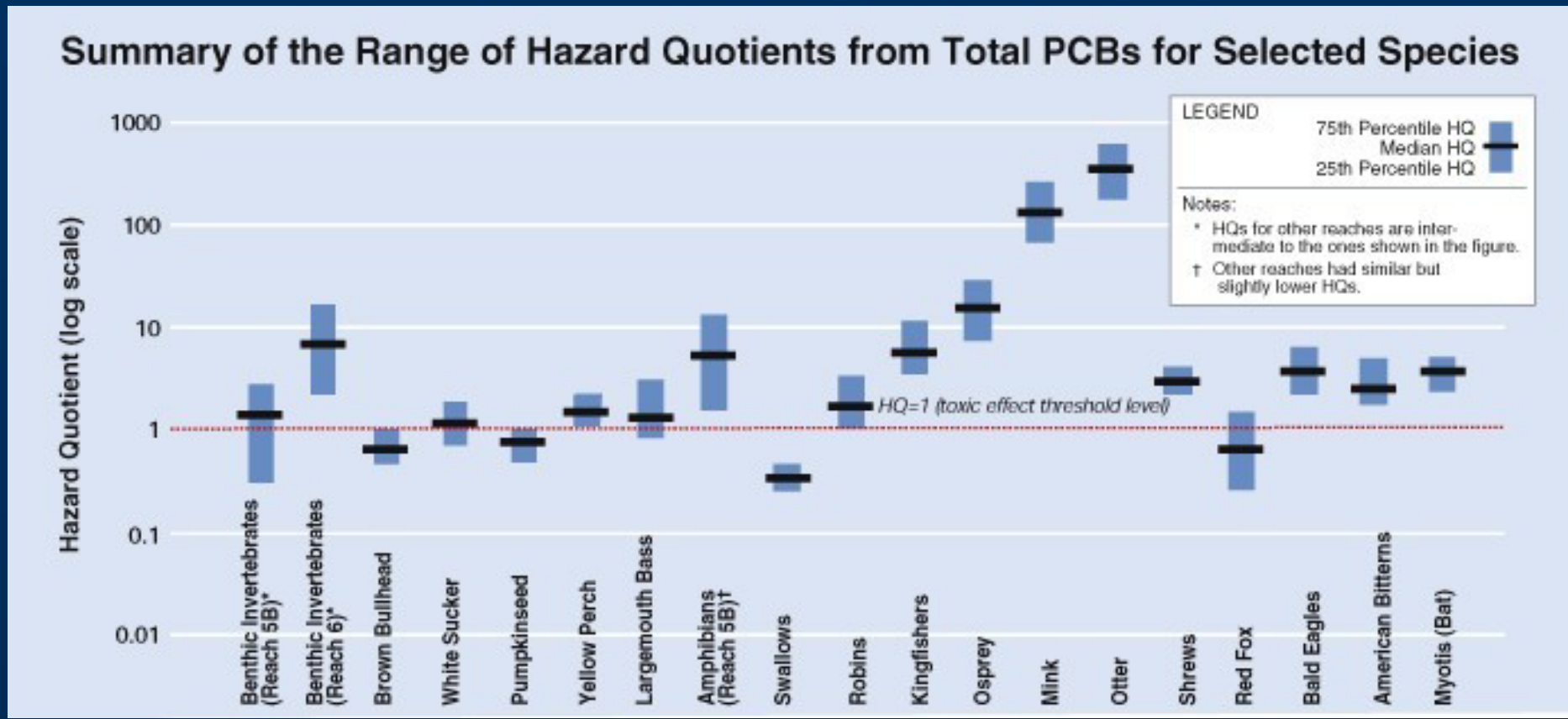

- WOE conclusion: **Intermediate** to **High** Risk for some species in some areas

# ERA Results – T & E Species

- Modeled exposure and effects
  - High risk for bald eagles
  - High risk for American bitterns
  - Intermediate risk for Small-footed myotis
- WOE conclusion – Intermediate to High Risk



# Summary of Risks in the PSA



# Risk Characterization

- Risks potentially extend to other species (e.g., other shrews)
- ERA below Woods Pond
  - Mink, otter, and bald eagles
  - Derived threshold concentrations for tissues
  - Compared thresholds to concentrations measured in fish
  - When exposure exceeded threshold = Potential risk
  - Mink at risk to Reach 10, and otter at risk to Reach 12